tion. They may be kept in a place convenient for observation by caging them in a vertical glass tube perforated sufficiently to secure equal density in the horizontal layers of liquid to be tested by the floaters.

An extemporised cell on this plan was exhibited to the Royal Society, and its resistance (measured as an illustration of Mance's method, described in the first of his two previous communications) was found to be ·29 of an Ohm (that is to say, 290,000,000 centimetres per second). The copper and zinc plates of this cell, being circular, were about thirty centimetres in diameter, and the distance between them was about 7·5 centimetres. A Grove's cell, of such dimensions that forty in series would give an excellent electric light, was also measured for resistance, and found to be ·19 of an Ohm. Its intensity was found to be 1·8 times that of the new cell, which is the usual ratio of Grove's to Daniell's. Hence seventy-two of the new cells would have the intensity of forty of Grove's. But the resistance of the seventy-two in series would be 209 Ohms, as against 76 Ohms of the forty Grove's; hence, to get as powerful an electric light, threefold surface, or else diminished resistance by diminished distance of the plates, would be required. How much the resistance may be diminished by diminishing the distance rather than increasing the surface, it is impossible to deduce from experiments hitherto made.

Two or three cells, such as the one shown to the Royal Society, will be amply sufficient to drive a large ordinary turret-clock without a weight; and the expense of maintaining them will be very small in comparison with that of winding the clock. The prime cost of the heavy wheel-work will be avoided by the introduction of a comparatively inexpensive electro-magnetic engine. For electric bells, and all telegraphic testing and signalling on shore, the new form of battery will probably be found easier of management, less expensive, and more trustworthy, than any of the forms of battery hitherto used. For use at sea, it is probable that the sawdust Daniell's first introduced on board the *Agamemnon* in 1858, and ever since that time very much used both at sea and on shore, will still be found the most convenient form; but the new form is certainly better for all ordinary shore used.

The accompanying drawing represents a design suitable for the electric light, or other purposes, for which an interior resistance not exceeding $\frac{2}{10}$ of an Ohm is desired. The zinc is in the form of a grating, to prevent the lodgment of bubbles of hydrogen gas, which I find constantly, but very slowly, gathering upon the zincs of the cells I have tried, although the solutions used have no free acid, unless such as may come from the ordinary commercial sulphate of copper and commercial sulphate of zinc crystals which were used.

The principle which I have adopted for keeping the sulphate of copper from the zinc is to allow it no access to the zinc except by true diffusion. This principle would be violated if the whole mass of the liquid contiguous to the zinc is moved toward the zinc. Such a motion actually takes place in the second form of element (that which is represented in the drawing, and which is undoubtedly the better form of the two) every time the crystals of sulphate of copper are dropped into the charging-tube. As the crystals dissolve, the liquid again sinks, but not through the whole range through which it rose when the crystals were immersed. It sinks further as the sulphate of copper is electrically precipitated on the copper plate below in course of working the battery. Neglecting the volume of the metallic copper, we may say, with little error, that the whole residual rise is that corresponding to the volume of water of crystallisation of the crystals which have been introduced and used. It becomes, therefore, a question whether it may not become a valuable economy to use anhydrous sulphate of copper instead of the crystals; but at present we are practically confined to the "blue vitriol" crystals of commerce, and therefore the quantity of water added at the top of the cell from time to time must be, on the whole, at least equal to the quantity of water of crystallisation introduced below by the crystals. Unless a cover is added to prevent evaporation, the quantity of water added above must exceed the water of crystallisation introduced below by at least enough to supply what has evaporated. There ought to be a further excess, because a downward movement of the liquid from the zinc to the level from which the syphon draws is very desirable to retard the diffusion of sulphate of copper upwards to the zinc. Lastly, this downward movement is also of great value to carry away the sulphate of zinc as it is generated in the use of the battery. The quantity of water added above ought to be regulated so as to keep the liquid in contact with the zinc, a little less than half saturated with sulphate of zinc, as it seems, from the observations of various experimenters that, the resistance of water semisaturated with sulphate of zinc is considerably less than that of a saturated solution. A still more serious inconvenience than a somewhat increased resistance has been pointed out to me by Mr. Varley as a consequence of allowing sulphate of zinc to accumulate in the battery. Sulphate of zinc crystallises over the lip of the jar, and forms pendants like icicles outside, which act as capillary siphons, and carry off liquid. Mr. Varley tells me that this curious phenomenon is not unfrequently observed in telegraph batteries, and sometimes goes so far as to empty a cell and throw it altogether out of action. Even without this extreme result, the crystallisation of zinc about the mouth of the jar is very inconvenient and deleterious. It is of course altogether avoided by the plan I now propose.

In conclusion, then, the siphon-extractor must be arranged to carry off all the water of crystallisation of the sulphate of copper decomposed in the use of the cell, and enough of water besides to carry away as much sulphate of zinc as is formed in the use of the battery. Probably the most convenient mode of working the system in practice will be to use a glass capillary siphon, drawing quickly enough to carry off in a few hours as much water as is poured in each time at the top; and to place, as shown in the drawing, the discharging end of the siphon, so as to limit the discharge to level somewhat above the upper level of the zinc grating. It will no doubt be found convenient in practice to add measured amounts of sulphate of copper by the charging-tube each time, and at the same time to pour in a measured amount of water, with or without a small quantity of sulphate of zinc in solution.

As 100 parts by weight of sulphate of copper crystals contain, as nearly as may be, 36 parts of water, it may probably answer very well to put in, for every kilogramme of sulphate of copper, half a kilogramme of water. Experience (with the aid of specific-gravity beads) will no doubt render it very easy, as a perfectly methodical action involving very little labour, to keep the battery in good and constant action, according to the circumstances of each case.

When, as in laboratory work, or in arrangements for lecture-illustrations, there may be long intervals of time during which the battery is not used, it will be convenient to cease adding sulphate of copper when there is no immediate prospect of action being required, and to cease pouring in water when little or no colour of sulphate of copper is seen in the solution below. The battery is then in a state in which it may be left untouched for months or years. All that will be necessary to set it in action again will be to fill it up with water to replace what has evaporated in the interval, and stir the liquid in the upper part of the jar slightly, until the upper specific gravity-bead is floated to near the top by sulphate of zinc, and then to place a measured amount of sulphate of copper in the funnel at the top of the charging-tube.

W. THOMSON

NOTES

AT the Anniversary Meeting of the Geological Society, held on the 17th ult., the Wollaston Gold Medal was presented to Prof. Ramsay in recognition of his many researches in practical and in theoretical geology; and the balance of the proceeds of the Wollaston Donation Fund was given to Mr. Robert Etheridge in aid of the publication of his great stratigraphical "Catalogue of British Fossils." A report of the interesting proceedings on the occasion will be found in another column. Mr. Prestwich was re-elected President of the Society for the ensuing year.

A STATUTE was promulgated last week in Convocation at Oxford enlarging the powers of the delegates of "unattached students," whom it is proposed to allow to admit students after examining them in one of the subjects already permitted (*i.e.*, Classics and Mathematics), "together with some other subject recognised in the schools of the University" (*e.g.*, Physical or Natural Science).

We are indebted to *Harper's Weekly* for some of the interesting notes on science in America, which we are able to furnish this week, in advance of their publication there. This magazine provides its readers with an important and interesting summary in each issue of the progress of science on that side of the Atlantic.

Dr. Willie Kühne, at present Professor of Physiology at Amsterdam. has been called to occupy the chair left vacant at Heidelberg by the removal of Helmholtz to Berlin.

It is with great pleasure that we hear from the Abbé Moigno that the publication of *Les Mondes* will have recommenced before this, on March 1. Though the Abbé has escaped uninjured from the bombardment, a portion of his fine library was destroyed by a Prussian shell. We are still without files of any of the Paris papers.

In reply to a question in the House of Commons on Friday night last, Mr. Ayrton said that considerable progress had been made in the preparation of the plans for the erection of the Natural History Museum at South Kensington, but until they had been completed it would be impossible for them to receive the sanction of the Government.

The lectures of the present year for the Royal College of Physicians will be delivered at the College, Pall Mall East, at five o'clock on each of the following Wednesdays and Fridays Gulstonian lectures—Dr. Gee, March 3, 8, 10, "On the Heat of the Body;" Croonian lectures—Dr. Parkes, March 15, 17, 22, "On some points connected with the Elimination of Nitrogen from the Human Body;" Lumleian lectures—Dr. West, March 24, 29, 31, "On some disorders of the Nervous System in Childhood."

The third course of Cantor Lectures for the Session of the Society of Arts will be delivered by Dr. T. S. Cobbold, F.R.S., and will treat of "Our Food-producing Ruminants, and on the Parasites which reside in them." The course will commence on Monday, the 17th of April, and will be continued on subsequent Monday evenings till completed. These lectures are open to members, who have also the privilege of admitting two friends to each lecture.

Mr. Andrew Murray will, during the following season, deliver a short course of lectures for the Royal Horticultural Society on Economic Entomology, especially in its relations to Horticulture and Forestry. Mr. Murray has been mainly instrumental in forming the Society's collection of Economic Entomology exhibited in the South Kensington Museum.

Florida has, this winter, its usual complement of scientific visitors, who are engaged in prosecuting investigations upon its natural history. Mr. E. J. Maynard, of Massachusetts, is exploring the ornithology of the keys and the southern portion of the State; Mr. N. H. Bishop, of New Jersey, and Mr. George A. Boardman, of Maine, are at work with a similar object about Jacksonville. Professor Wyman, of Cambridge, is also making use of the opportunities of his third or fourth visit to the State in the critical examination of the ancient mounds and shell heaps which abound everywhere.

Dr. Packard has lately announced the discovery, by Prof. Verrill, of a dipterous larva of the genus *Chironomus*, at a depth of 120 feet, in the vicinity of Eastport, Maine. He also describes. a mite, or *Acarus*, as occurring at a similar depth. He has not yet ascertained whether, like other species of the genus, the latter lives, in any of its stages, in the gills of the lamellibranchiate mollusca.

A recent communication to the State Department from the United States consul at St. Helena, states the fact that the white ants, which have effected a lodgment in the island, are rapidly destroying everything upon it. No wood but teak, and sometimes not even that, escapes their fangs; and numbers of houses in Jamestown have been fairly gutted by them—doors, window-sashes, floors, and roofs, all being eaten up, leaving nothing but the bare walls.

The following is a list of the German learned men connected with the French Académie des Sciences, copied from the *Comptes Rendus*, although some of them have died since the investment of the city, but their names were not erased from the list for want of official notification:—Four Associates, MM. Ehrenberg, Liebig, Wöhler, Kummer: three mathematicians, Neumann, Weierstrass, Kronecker; one mechanician, Clausius; three astronomers, Hansen, Argelander, Peters; three physicists, Weber, Mayer, Kirchhoff; two chemists, Bunsen, Hofmann; three mineralogists, Naumann, Rose, Haidinger; four botanists, Mohl, Braun, Hofmeister, Pringsheim; one anatomist, Siebold; three surgeons, Virchow, Rokitansky, Sebert.

The special correspondent of the *Times* gives the following account of the effects of the bombardment on the Jardin des Plantes:—No fewer than eighty-three shells had fallen within this comparatively limited area. On the night of January 8 and 9 four shells fell into the glass houses and shattered the greater part of them to atoms. A heap of glass fragments lying hard by testified to the destruction, but the effect of the shells was actually to pulverise the glass, so that it fell almost like dust over the gardens. The consequence was that nearly the whole of this most rare and valuable collection was exposed to one of the coldest nights of the year, and whole families of plants were killed by the frost. Some of the plants suffered the most singular effects from the concussion; the fibres were stripped bare, and the bark peeled off in many instances. All the Orchids, all the Clusiaceæ, the Cyclantheæ, the Pandaneæ were completely destroyed, either by the shells themselves or by the effects of the cold. The large palm-house was destroyed, and the tender tropical contents were exposed to that bitterly cold night; yet, singularly enough, although they have suffered severely, not one has yet died. All through the whole of the fortnight during which these gardens were subjected to this rain of shells, MM. Decaisne, Chevreuil, and Milne-Edwards, remained at their posts, unable to rest, and have since, at their own expense, repaired the damage done, trusting that whatever form of government France may choose, it will not repudiate its debts of honour. M. Decaisne is making out a list of his losses, a large proportion of which might possibly be supplied from Kew, while owners of private collections might also be glad to testify their sympathy and interest in the cause of science by contributing whatever they may be able to spare as soon as the amount and nature of the loss is ascertained. The animals fared better than the plants—not only have none of them been eaten by the population of Paris, as the latter fondly suppose, but although several shells burst among them, they have escaped uninjured. Of course, when food was so scarce for human beings, the monkeys and their companions were put upon short allowance. This fact, coupled with the extreme rigour of the season, increased the rate of mortality among them, and one elephant died, but was not eaten. The two elephants and the camel that were eaten belonged to the Jardin d' Acclimatation, and had been removed in the early stage of the siege from their ordinary home in the Bois de Boulogne, for safety, to the Jardin des Plantes, where, however, it would appear, it was not to be found. The birds screamed and the animals cowered, as the shells came rushing overhead and bursting near them, as they do when some terrific storm frightens them; latterly they seemed to become used to it.

We have great pleasure in announcing that the Museum of Natural History at Strasburg has escaped the bombardment of the town. One shell entered one of the corridors and destroyed a small collection of chalk fossils, and a few fragments of a shell decapitated two or three birds. The concussion caused nearly all the glass in the cases to be broken. But the fine collections of mammals, of birds, and of fossils, the result of many years of labour of Prof. Schimper, are perfectly untouched. This has not been the case with some of the private collections in the town, and one, a collection of European Lepidoptera, belonging to the Taxidermist of the museum, was scattered into dust.

We learn with great regret that the Société d' Acclimatation of Paris has thought it necessary to pass a resolution erasing from the list of its members all sovereigns and princes of German States engaged in the late war against France, "considérant que la manière dont le bombardement de Paris a été effectué par les armées allemandes constitue un acte contraire au droit des gens, ainsi qu'aux plus simples notions de l' humanité."

Among the experiences of the Mount Washington winter party may be mentioned an exposure to perhaps the greatest cold ever recorded in the annals of science. The temperature of 40° below zero was not in itself unusual; but to this was added a hurricane blowing at the rate of ninety miles an hour. The combination of such a wind with the temperature indicated would probably have been entirely unsupportable but for the means of protection enjoyed by the party in the dwelling which had been fitted up expressly for their accommodation.

Prof. J. Young has recently brought the question of the education of the mining engineers before the Institution of Engineers for Scotland. His proposals for its amelioration are as follows:—"1. Great improvement in secondary schools, especially in teaching arithmetic, geometry, elements of natural philosophy. 2. The establishment in some large towns, such as Liverpool and Birmingham, of colleges on the Scottish model, or on that of Owens College—fairly well endowed—giving chiefly general scientific training, with a few special technical chairs. 3. The practical recognition of the value of scientific training by engineers who take pupils. (*a*) By giving free pupilships or valuable scholarships; (*b*) By admitting as pupils only those who have passed certain recognised examinations; (*c*) By co-operating with colleges as examiners; (*a*) By inserting in agreements with their pupils that during winter they shall attend certain classes; (*e*) By giving some privileges, in connection with engineering societies, to graduates."

We regret to learn that the fine specimen of *Pandanus odoratissimus* in the Botanical Gardens at Glasnevin, near Dublin, has been completely destroyed by the attacks of a fungus, in all probability the same that has destroyed the Screw Pine in the Breslau Gardens, as referred to by Prof. Oliver in a late number of this journal. The Glasnevin plant was nearly fifty years old.

Messrs. Bell and Daldy will shortly publish "Outlines of Magnetism and Electricity for Public Schools and Science and Art Examinations," being notes of a course of lectures delivered at the Royal School of Naval Architecture, with an introduction on the First Principles of Physics, by W. F. Barrett.

We learn from the *British Medical Journal* that Dr. Thorne Thorne, who has been very successfully engaged for several years as an occasional inspector under the Privy Council, and who more especially led to the exposure of the causes of the Terling epidemic, has been appointed to a permanent position under the Privy Council.

The *British Medical Journal* states that the rumour that Dr. Liebreich, the distinguished ophthalmologist of Paris, was likely to be appointed ophthalmic surgeon and lecturer at St. Thomas's Hospital, is likely to be realised. The reputation of Dr. Liebreich is more than European, and his services to ophthalmoscopic science and practice are such that he may fairly claim to be considered as almost the founder of our present school of ophthalmoscopy. The services which he has rendered to science are cosmopolitan, and we feel assured that if, under the existing state of affairs in Paris, Dr. Liebreich elects to take up his residence in London, his services, reputation, and personal character will secure for him that welcome which the English profession has always been wont to extend to distinguished men of science of every nation, and which well becomes the members of a liberal profession in a country proud of its freedom and hospitality.

Two natives of the Garrow Hills in Madras are to be trained as vaccinators to practise in their tribe, which suffers severely from small-pox. On the other hand the villages in Kunnool oppose the entrance of vaccinators by force, and hide their children in the jungle.

The Siam papers report the fortunate news of the capture of an albino or white elephant. He had been brought to the capital in state, and will in due time succeed to the highest dignities of state, the chief white elephant ranking next the Queen, and the heir apparent coming next only to this elephant.

Mr. W. King, of the Indian Geological Survey, reports from Ballary, in Madras, that he doubts the reported discovery of coal in that district.

The *Homeward Mail* states that the cold has been so intense at the Mullier in Scinde lately, that on January 24th icicles were found on the works connected with the viaduct in that place. It is hardly possible to believe this phenomenon were it not communicated by a reliable eye-witness.

A paper, read to the Academy of Sciences, Paris, during the siege, gives some very interesting information about the great cold experienced there, and its occurrence in former years. In the fifty years from 1816 to 1866, the average temperature of the month of December has been 3·54° Centigrade above zero, but December, 1870, gave an average of 1·07° C. *below zero*, thus showing how far below the average the cold of last year was. In the *Annales de la Société Météorologique*, vol. v., 1861, is a paper by M. Renou, "On the Periodicity of Great Cold." In this he shows that about every forty years there comes round a series of cold winters, in general five or six together, of which the central one is the coldest of all. His researches extend back to the fifteenth century, but to take recent times he notices the great frosts and cold winters which group themselves round the years 1709, 1748, 1789-90, and again in 1829-30. From these facts he predicted in 1860 that there would be a group of severe winters round the winter of 1870-71.

In furtherance of the British Guiana Local Exhibition to be held in that Colony during the present year, the Committee of Correspondence has issued an address to the "Farmers and other Proprietors of the Soil," calling upon them energetically not only to aid the Exhibition by simply sending specimens of the products of the Colony to be seen, passed by, and forgotten, but to bear in mind how many useful products are lost to commerce through lack of continued exertions in the cultivation of the plants and the supply of the home market, and pointing out how that Exhibitions "can never be regarded as entirely satisfactory until additions are permanently made to the stock of commodities which are in daily use at home, as well as to the list of such as make the resources and the importance of the Colony known and esteemed in the markets of the world." British Guiana is a colony rich in natural productions, and it is to be hoped that the pamphlet will be read and digested by those to whom it is addressed.

Another tigress is recorded as dead in India, at the hands of Major Daires, of the Madras Presidency, and none too soon. She had, in seven years, killed above 140 persons in a few villages, so that many families had left, and a great part of the land had gone out of cultivation.

On the 28th October two shocks of earthquake were felt at Shikarhera, in Upper Scinde. On the 1st November a severer shock was felt in the Tinnevelley district than ever had been known in the memory of man. The shocks were undulatory.